spiral in sixty-seven by the fifth, sixth, seventh, and eighth, in six by all five, and in one (same anomaly) by the sixth and seventh.

I will also add that the sensory and motor fibres of each trunk are thoroughly mixed by the time that they emerge from the intervertebral foramina, so as not to be distinguishable from each other. The two roots (sensory and motor), on coming together a short distance from the intervertebral foramen, immediately commingle their filaments.

It will be seen from the description of the nerves previously given, that in case it becomes necessary to destroy the distributions of the nerves of the inner side of the arm, the small branch from the outer cord to the ulnar and the internal head of the median will have to be cut as well as the inner cord. It should also be remembered in operations upon the plexus that the small branch from the fourth cervical does not run into the plexus proper, but is simply confined to the branch to the rhomboid muscle, and that the intercosto-humeral joins the lesser internal cutaneous in the lower third of the axilla.

I desire to take the opportunity here of expressing my sincere thanks to Drs. W. W. Keen and H. C. Chapman for the kind interest which they chose to take in my work, and for the many facilities for dissection and observation afforded me by them.

ARTICLE VII.

FALLACIES OF REINSCH'S TEST FOR ARSENIC.

By THEODORE G. WORMLEY, M.D., Professor of Chemistry in the Medical Department of the University of Pennsylvania.

IN the application of Reinsch's test for the detection of arsenic, as is well known, the physical appearance of the deposit will rarely enable the observer to state, with any degree of certainty, its true nature, since there are other metals that will deposit upon the copper under like conditions, and may present a very similar appearance. Hence, to determine the true nature of the deposit it is necessary to subject it to a further or confirmatory test, which usually consists in heating the coated copper in a reduction-tube, and observing the character of the sublimate, if any, produced, which in the case of arsenic consists of octahedral crystal, even if only an almost infinitesimal quantity of that metal be present.

The production of these crystals has generally been considered conclusive evidence of the presence of arsenic, since the only other metals that will yield sublimates are mercury, in which the sublimate is in the form of minute globules, and antimony, which, as usually stated, will yield an amorphous sublimate.

The statements in regard to the behaviour of the antimony deposit, however, have been somewhat discordant. Thus, by some writers, it is stated that this metal fails to yield any sublimate whatever; by others, that it yields an amorphous sublimate; and by others still, that the deposit is either amorphous or granular. According to Professor W. A. Miller, however, the antimony deposit, when heated, "gradually becomes oxidized, and at a higher temperature the oxide is volatilized, condensing in needles; not, like arsenic, in octahedra." (*Elements of Chemistry*, ii. p. 602.)

This statement of Professor Miller was strongly urged a few years since in a somewhat noted trial as evidence of the *absence* of antimony, since on the application of the copper test there was a failure to obtain crystalline needles. Immediately after this trial, in 1872, we very carefully examined this test in regard to the character of the sublimate produced by antimony. In over fifty consecutive experiments of this kind, in which copper, pretty heavily coated with antimony, but used in small portions at a time, was employed, we failed to obtain well-defined crystalline needles, except in some three or four instances in which a few needles were observed, and in one in which the sublimate consisted largely of large groups of prismatic needles with single prisms.

But, what is of more importance in a forensic point of view, we found that the sublimate produced from antimony might contain *octahedral crystals* of antimonic oxide, and that under certain conditions it was almost sure to contain such crystals. In a number of instances sublimates were obtained, which, when examined under the microscope, presented fields which, taken alone, could not be distinguished from an arsenical sublimate by the most experienced eye.

These octahedral crystals are more likely to form when the heat is applied very gradually, and especially when the reduction-tube is relatively large to the quantity of deposit submitted to sublimation. In no instance were octahedral crystals obtained when a very narrow or contracted tube was employed. It would thus appear that for the production of crystals, antimony required a more free supply of air than arsenic, although the absolute quantity of oxygen required is less.

Although it is thus possible to obtain from antimony sublimates, certain portions of which, under the microscope, are not to be distinguished from the results obtained from arsenic, yet there is considerable difference in the general behaviour of these metals under the action of this test.

1. The antimony deposit requires a much higher temperature to volatilize it, vapourizing at little, if any, below a dull red heat; whereas, according to recent investigations, metallic arsenic volatilizes at about 356° F., or, according to Professor Guy, even so low, when in small quantity, as 230° F.

2. The position of the sublimate in the reduction-tube, as usually ob-

tained, may serve at once to distinguish the antimonial from the arsenical deposit. In the case of antimony, on account of its less volatility, the lower margin of the sublimate (in which the crystals, when present, are found) is only slightly in advance of the slip of copper, or the sublimate may even form on the sides of the tube surrounding the copper, especially when the heat is restricted to the lower end of the tube; whilst, as is well known, in the case of arsenic the sublimate usually forms half an inch or more in advance of the copper foil.

3. The general appearance of the sublimate under the microscope, even when octahedral crystals are present, usually differs very greatly from that obtained from arsenic, the octahedra being confined to the lower margin of the sublimate, and many more appearing opaque than in the case of that metal, and there being many granular and opaque points interspersed among the crystals. Moreover, only a single field, or at most a very small portion of the sublimate will present crystals, the other portions being either wholly amorphous, or at most granular.

As is well known, the arsenical sublimate, as usually obtained, consists wholly of octahedral crystals, which gradually diminish in size from the lower portion of the sublimate to the upper margin, where, under a low power of the microscope, they may appear as mere points; which, however, under a higher power of the instrument, will be found to be perfect octahedra.

In a large series of experiments, after the manner in which this test is ordinarily applied for the detection of arsenic, we in no instance obtained from antimony a sublimate that could not readily be distinguished from a pure arsenical deposit; yet it must be borne in mind that, under certain conditions, it is possible to obtain from antimony a sublimate consisting largely, if not wholly, of octahedral crystals, and presenting to the naked eye the sparkling appearance usually presented by the arsenical sublimate. In the instance already mentioned, in which large groups of prismatic needles were obtained, very many octahedra were interspersed among the prisms.

From the foregoing statements it is obvious that the mere production of octahedral crystals by this test is not, in itself, conclusive proof of the presence of arsenic. When examining this test in the preparation of the *Micro-Chemistry of Poisons*, we in a few instances observed minute octahedra, which at the time were attributed to the presence of a trace of arsenic in the antimony compound employed. The entire absence of that metal in the present experiments was fully established.

We also find that the deposit of metallic antimony formed in the exit-tube of a Marsh apparatus by decomposing antimonuretted hydrogen by heat, may, when the tube is detached and the deposit again heated, be in part at least converted into octahedral crystals of the oxide.

If pure antimonic oxide be vapourized in a small tube, the sublimate usually contains octahedral crystals, but sometimes crystalline needles. According to our experiments, octahedra are much more likely to be present than needles; the opposite result, however, is stated by several writers.

Our experience has confirmed the observation first made by Mitcherlich, that when a solution of tartar emetic is decomposed by excess of ammonia, the precipitated antimonic oxide is after a time converted, in part at least, into minute octahedra.

Another fallacy that may be mentioned in this connection, although first pointed out some years since by Reinsch, is that of *sulphurous acid.* If this acid, either in its free state or as an alkaline sulphite, be present with bright copper foil, on heating the acidulated mixture, or even if sulphurous acid be present in comparatively large quantity, without the application of heat, the copper receives a deposit or coating which in appearance may not be unlike that produced by arsenic. This coating may, after a time, become detached in the form of metallic-like flakes. We find these detached flakes to be a definite sulphuret of copper in the proportion of two atoms of the metal with one atom of sulphur, Cu_2S.

If the coated copper be heated in a reduction-tube, a portion of the sulphur may be volatilized and condense in the upper portion of the tube. In no instance, however, did we obtain a sublimate that could be mistaken for that from arsenic by an observer having even only a limited experience with the appearance of the arsenical sublimate.

Since sulphurous acid is frequently employed in the examination of suspected organic mixtures as a reducing agent, it is important to bear in mind that the acid may thus produce a deposit on copper; especially as a sulphur deposit of this kind may greatly interfere with obtaining satisfactory results from arsenic itself when present only in minute quantity.

When present in its free state, sulphurous acid is rather readily expelled from a solution by heat; but when present as an alkaline sulphite, it requires the prolonged action of heat for its entire expulsion, even in the presence of a free mineral acid.

PHILADELPHIA, Sept. 1, 1877.

ARTICLE VIII.

A CONTRIBUTION TO THE ANATOMY OF THE HUMAN RETINA.

By W. F. NORRIS, A.M., M.D., Clinical Professor of Ophthalmology in the University of Pennsylvania, and E. O. SHAKESPEARE, A. M., M.D., Lecturer on Refraction and Accommodation and Operative Ophthalmic Surgery in the University of Pennsylvania.

THE complicated structure of the retina, and its rapid change and disorganization after death have, ever since the introduction of the micro-